

ONKYO® SERVICE MANUAL

Europe Model DIGITAL SYNTHESIZED FM STEREO TUNER Model T-909

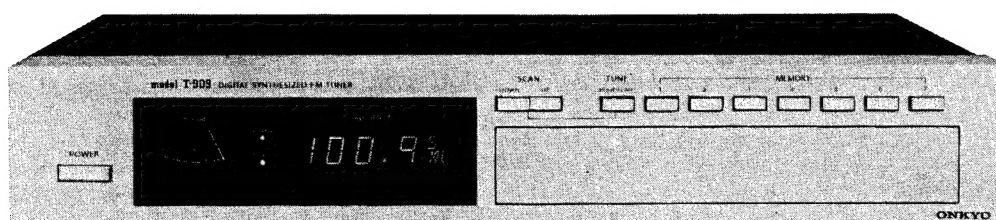


TABLE OF CONTENTS

Item	Page
Specifications	2
Precautions	2
Features	2
Circuit description	3
Exploded view	6
Component location	7
Alignment procedures	8
Digital section p.c.b. -parts list	10
Digital section-schematic diagram	11
Pin arrangements for digital IC	13
Tuner-schematic diagram	17
Tuner p.c.b. view	19
Tuner p.c.b. -parts list	21
Linear IC block diagram	22
Power supply p.c.b. view	24
Block diagram	25
Packing procedures	26

ONKYO®
AUDIO COMPONENTS

SPECIFICATIONS

Tuning Range:	87.50 ~ 103.95MHz	AM Suppression Ratio:	55 dB
Tuning increments:	50 kHz	Harmonic Distortion:	FM mono: 0.08% at 1 kHz FM stereo: 0.15% at 1 kHz
Usable Sensitivity:	FM mono: 9.8 dBf, 1.7 μ V IHF 1.3 μ V (S/N 26 dB, 40 kHz Devi.) DIN FM stereo: 17.2 dBf, 4 μ V IHF 45 μ V (S/N 46 dB, 40 kHz Devi.) DIN	Stereo Separation:	45 dB at 1 kHz 40 dB at 100~10,000 Hz
50 dB Quieting Sensitivity:	FM mono: 14.7 dBf, 3 μ V FM stereo: 36 dBf, 35 μ V	Subcarrier Suppression:	70 dB
Intermediate Frequency:	10.7 MHz	Muting Level:	17.2 dBf, 4 μ V
Capture Ratio:	1.5 dB	Stereo Threshold:	17.2 dBf, 4 μ V
Image Rejection Ratio:	85 dB	Frequency Response:	30~16,000 Hz (+0.5, -2dB)
IF Rejection Ratio:	100 dB	Tuning Frequency Accuracy:	30 ppm
Spurious Rejection Ratio:	105 dB	Power Supply Rating:	AC220 volts 50 Hz
Signal to Noise Ratio:	FM mono: 80 dB FM stereo: 74 dB	Antennas:	300 ohms balanced, 75 ohms unbalanced and 75 ohms type "F" connector
Alternate Channel Att.:	80 dB IHF	Semiconductors:	4 FETs, 56 ICs 49 Transistors, 63 Diodes
Selectivity:	75 dB DIN (\pm 300 kHz, 40 kHz Devi.)	Dimensions:	450 W x 3 1/4" x 13 15/16"
		Weight:	5.9 kg., 13.0 lbs.

Specifications and features are subject to change without notice.

PRECAUTIONS

All CMOS devices have diode input protection against adverse electrical environments such as static discharge.

Unfortunately, there can be severe electrical environments during the process of handling. For example, static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15 kV range (depending on humidity, surface conditions, etc.). These static voltages are potentially disastrous when discharged into a CMOS input considering the energy stored in the capacity (\approx 300 pF) of the human body at these voltage levels.

Present CMOS gate protection structures can generally protect against overvoltages. This is usually sufficient except in the severe cases. Following are some suggested handling procedures for CMOS devices, many of which apply to most semiconductor devices.

1. All MOS devices should be stored or transported in materials that are somewhat conductive. MOS devices must not be inserted into conventional plastic "snow" or plastic trays.
2. All MOS devices should be placed on a grounded bench surface and operators should ground themselves prior to handling devices, since a worker can be statically charged with respect to the bench surface.
3. Nylon clothing should not be worn while handling MOS circuits.
4. When lead straightening or hand soldering is necessary, provide ground straps for the apparatus used.
5. Double check test equipment setup for proper polarity of voltage before conducting parametric or functional testing.
6. All unused device inputs should be connected to V_{DD} or V_{SS} .

FEATURES

Quartz Controlled Tuning Accuracy

Onkyo has solved tuning accuracy problems once and for all by employing one of the most accurate and stable reference frequency sources known today - the quartz crystal oscillator in a quartz synthesizer tuning system. Not even the slightest hint of station drift can be detected, irrespective of widely varying operational conditions.

Front Panel Digital Frequency Display

Befitting its high degree of tuning accuracy and stability, the T-909 displays the tuned frequency in digital form. Tuning operations involve no more than the pushing of a few buttons - nothing could be simpler, nor any more accurate. Frequencies may be varied one at a time in 50 kHz steps (200 kHz steps for USA) or continuously at relatively high speed. And when the station has been accurately tuned, the TUNED indicator lamp will light up.

Tuning Memory for Automatic Tuning

A total of 7 favorite FM stations may be pre-set for automatic tuning. The actual setting operation involved is simplicity itself, while any pre-set memory may be cleared and reset for a new station with equal ease.

High Sensitivity Plus Superb Selectivity

With dual gate MOS FETs in the front-end RF stage and mixer circuit, and a tuned buffer circuit in the local oscillator, a truly excellent FM sensitivity of 1.7 μ V (9.8 dBf) has been attained. Distant FM stations that were once too remote for worthwhile FM listening are given greater clarity and brilliance. But what is even more remarkable is the conspicuous absence of interference, especially from adjacent stations.

Negligible Noise and Distortion

Although the T-909 has been designed for the ultimate in accuracy and speed, emphasis is also on quality of sound reproduction. An S/N ratio of 80 dB (mono) and a distortion rating of 0.08% (mono, 1 kHz) clearly reveal the extremely high standard of hi-fi FM reception achieved in the T-909.

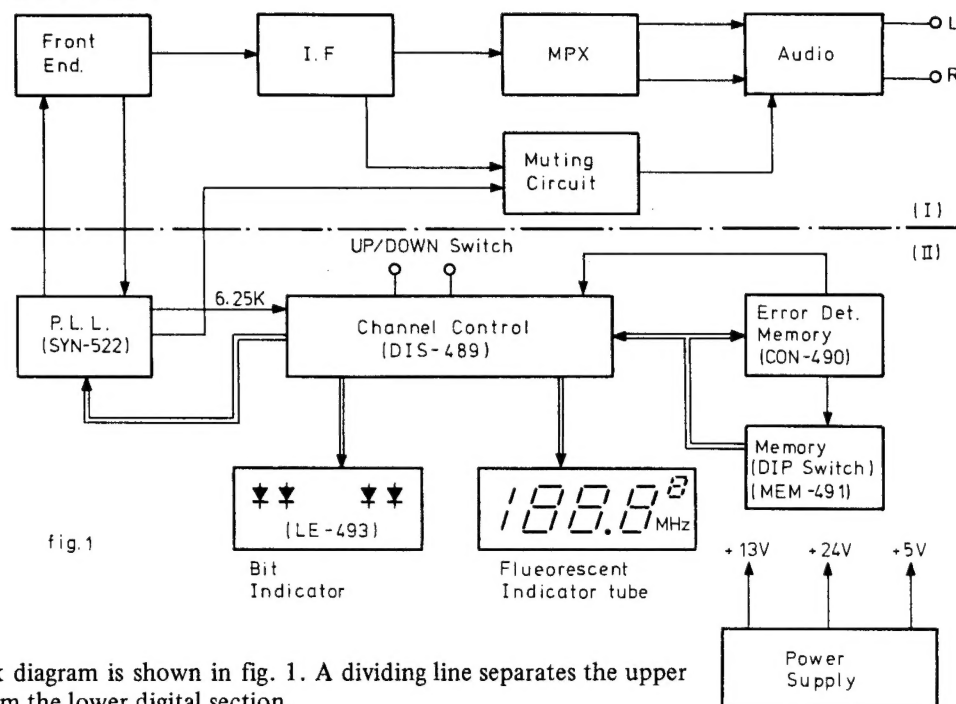
Other Outstanding Features

As could be expected of a tuner of this class, space does not permit details on the numerous other important features, such as the PLL MPX IC and pilot cancellor, signal strength meter, de-emphasis switch for Dolby * broadcasts, multipath detector terminals (for oscilloscope connection) and the gold-plated output terminals.

* "DOLBY" IS A REGISTERED TRADEMARK OF DOLBY LABORATORIES INC.

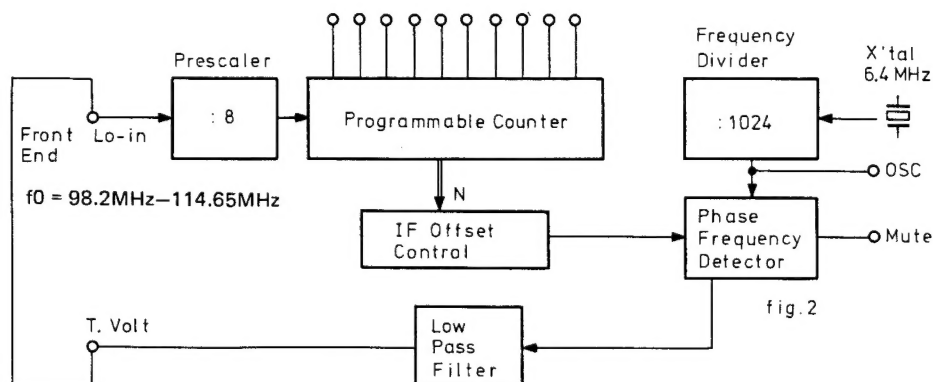
CIRCUIT DESCRIPTION

T-909 BLOCK DIAGRAM

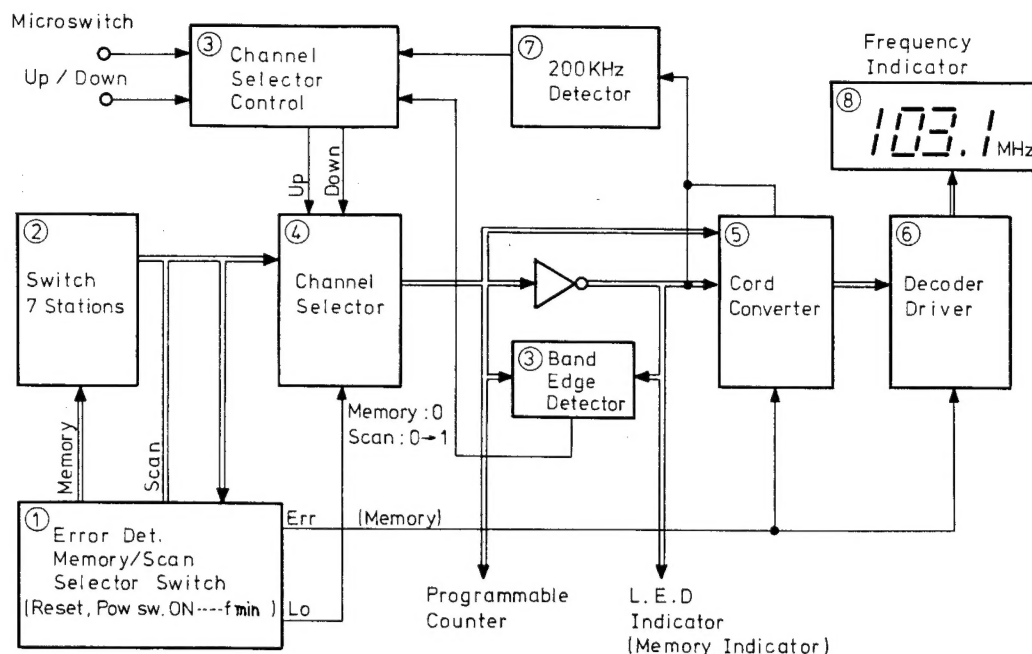


The T-909 block diagram is shown in fig. 1. A dividing line separates the upper linear section from the lower digital section.

SYN-522 BLOCK DIAGRAM



In conventional tuners, radio stations are "tuned" by varying the capacitance of a variable capacitor. In digital tuners, however, this tuning operation is achieved by varying the voltage applied to a variable capacitance diode. In the PLL circuit (block diagram shown in fig. 2), the subdivided oscillator frequency and a reference frequency undergo phase comparison to obtain the voltage to be applied to the variable capacitance diode.



1. Memory/Scan Selector Switch and Error Detector Circuit

The memory/scan selector switch contains 7 memory switching positions and 1 scan switching position.

The Lo terminal is 0 during "memory", but changes to 1 during "scan" when the scan frequency is stored in the channel selector by the time constant circuit.

The error detector circuit is activated whenever the code set by the memory DIP switch does not correspond to the code determined by the received frequency, resulting in the fluorescent E (Error) indicator lamp lighting up.

2. DIP Switch

By setting the DIP switch (tuned manually to light up the LED lamp) to the code determined by the received frequency, the frequency will be recalled from memory by pressing the switch.

3. Channel Selector Control

Scan pulse signals appear at the output whenever the UP or DOWN switches are pressed. Note, however, that the band edge detector is activated when either fmax (103.95MHz) or fmin (87.5 MHz) is reached, thereby stopping the output scan pulse signals.

4. Channel Selector

The input code is passed straight through to the output during memory mode, but when the scan switch is on, the code set by CON-490 (fmin = 87.5 MHz) is stored in the memory. That is, the input signal appears at the output when Lo is 0.

The code which has been stored in the memory by the scan pulse signal from the channel selector control then changes the received frequency by advancing or delaying the counter. Frequency is changed by 50 kHz per scan pulse.

5. Code Converter

The channel selector output code is distributed to each frequency unit column (100MHz, 10MHz, 1MHz, and 100 kHz), and then converted into binary numbers corresponding to decimal numbers.

6. Decoder/Driver

The code converted into binary form is then converted into a code form employed to drive the fluorescent indicator lamps. The 12.5 V drive voltage for these indicator lamps (the rest of the digital section employs high level voltage in the 3 to 5 V range) is obtained from the inverter C-MOS IC acting as a driver circuit.

7. 200 kHz Detector Circuit

Frequencies in the European model are changed in steps of 50 kHz, but in the USA model frequencies are changed in steps of 200 kHz. And since the channel selector counter is advanced or delayed by 50 kHz per step, the USA model is equipped with a 200 kHz detector circuit in order to advance or delay the channel selector counter 4 counts at a time.

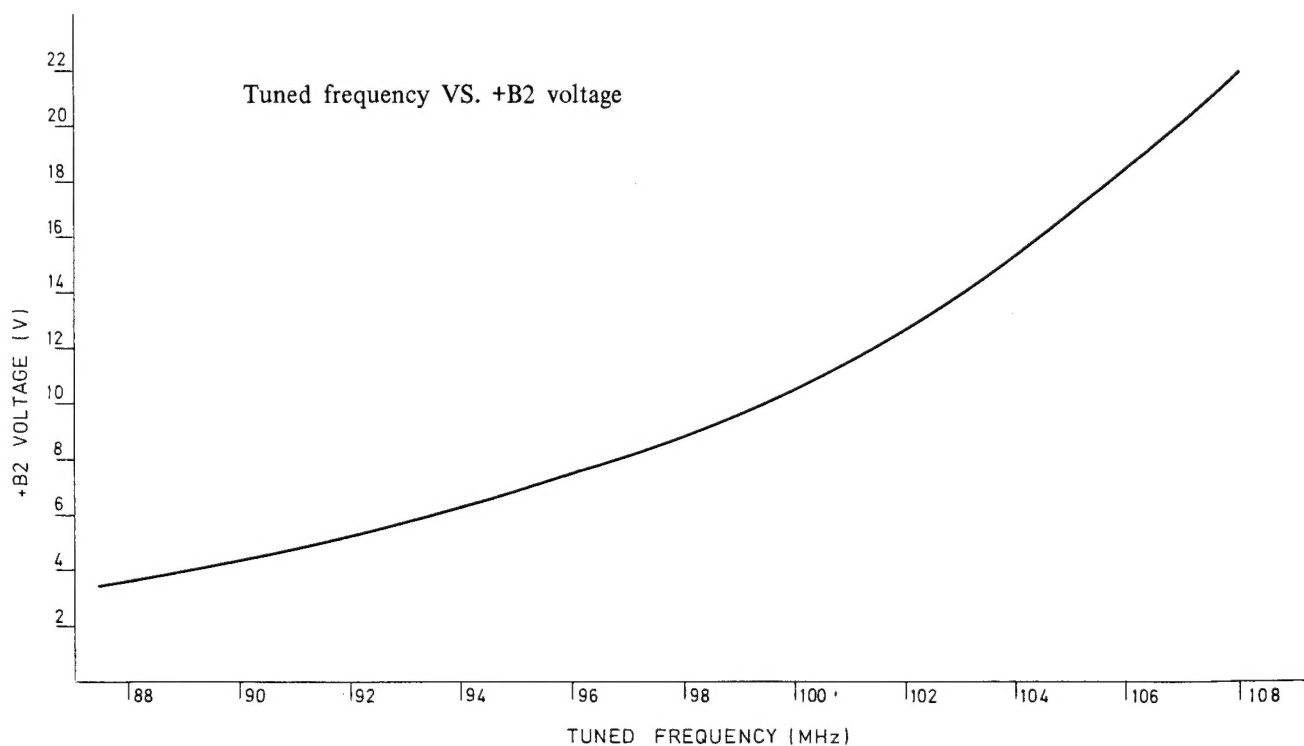
Tuned frequency and channel selector output cords

Frequency (MHz)	J	I	H	G	F	Frequency (MHz)	E	D	C	B	A
87	0	1	0	1	1	.00	0	0	0	0	0
88	0	1	1	0	0	.05	0	0	0	0	1
89	0	1	1	0	1	.10	0	0	0	1	0
90	0	1	1	1	0	.15	0	0	0	1	1
91	0	1	1	1	1	.20	0	0	1	0	0
92	1	0	0	0	0	.25	0	0	1	0	1
93	1	0	0	0	1	.30	0	0	1	1	0
94	1	0	0	1	0	.35	0	0	1	1	1
95	1	0	0	1	1	.40	0	1	0	0	0
96	1	0	1	0	0	.45	0	1	0	0	1
97	1	0	1	0	1	.50	1	0	0	0	0
98	1	0	1	1	0	.55	1	0	0	0	1
99	1	0	1	1	1	.60	1	0	0	1	0
100	1	1	0	0	0	.65	1	0	0	1	1
101	1	1	0	0	1	.70	1	0	1	0	0
102	1	1	0	1	0	.75	1	0	1	0	1
103	1	1	0	1	1	.80	1	0	1	1	0
104	1	1	1	0	0	.85	1	0	1	1	1
105	1	1	1	0	1	.90	1	1	0	0	0
106	1	1	1	1	0	.95	1	1	0	0	1
107	1	1	1	1	1						

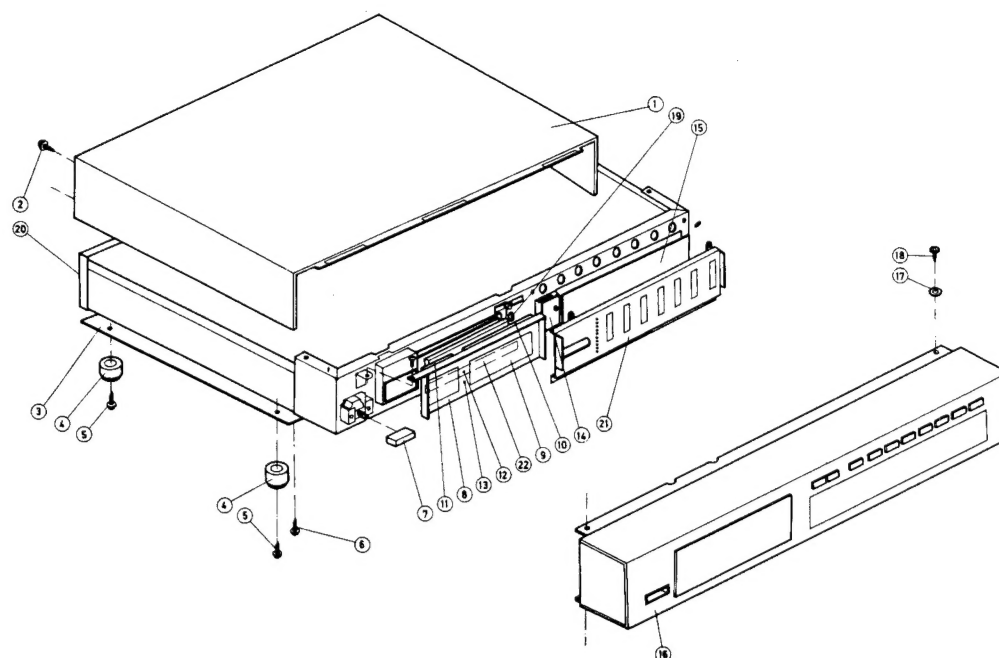
Band Edge Control Cords

	J	I	H	G	F	E	D	C	B	A
UP	1	1	0	1	1	1	1	0	0	0
DOWN	0	1	0	1	1	1	0	0	1	0

NOTES: The frequency when set the power switch to ON or the tuned switch to reset is 87.5MHz



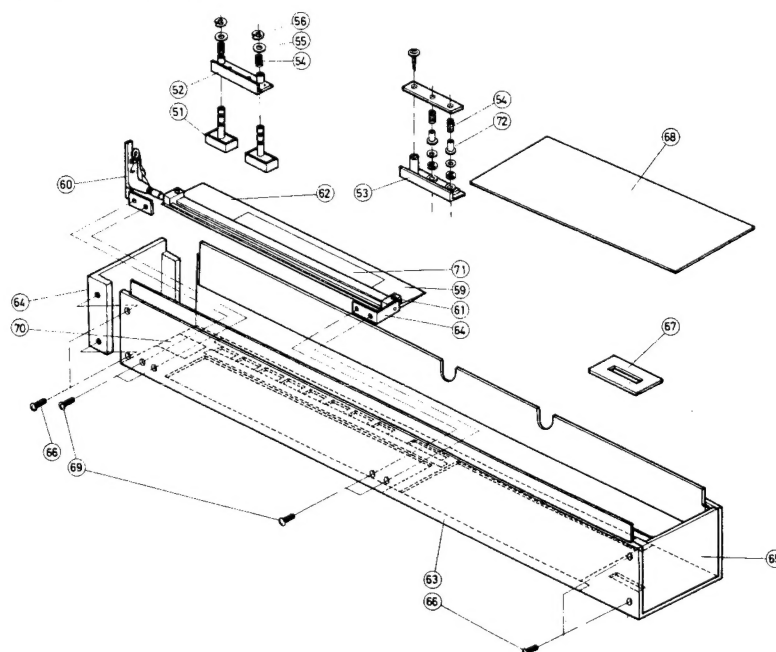
EXPLODED VIEW



EXPLODED VIEW-PARTS LIST

Ref. No.	Parts No.	Description	Ref. No.	Parts No.	Description
1	2811044	Top cover	12	225018	GL-2PR1, Stereo indicator L.E.D.
2	831430082	3STW+8BQ (BC)	13	225019	GL2PG1, Tuned indicator L.E.D.
3	27170042	Bottom board	14	13752593	NALE-493, L.E.D. P.c.b.
4	280379	Leg	15	13752591	NAMEM-491, Memory p.c.b.
5	834130122	3STS+12BQ	16	13752121	Front panel ass'y
6	831130082	3STW+8BQ	17	87313006	M-3B
7	28320168A-1	Power switch knob	18	831130082	3STW+8BQ
8	28133008	Plate	19	27300107	Programming stylus
9	28191026	Smoking plate	20	27120116	Back panel
10	28140102	Cushion	21		Plate (M)
11	28140103	Cushion	22	28142602	Cushion

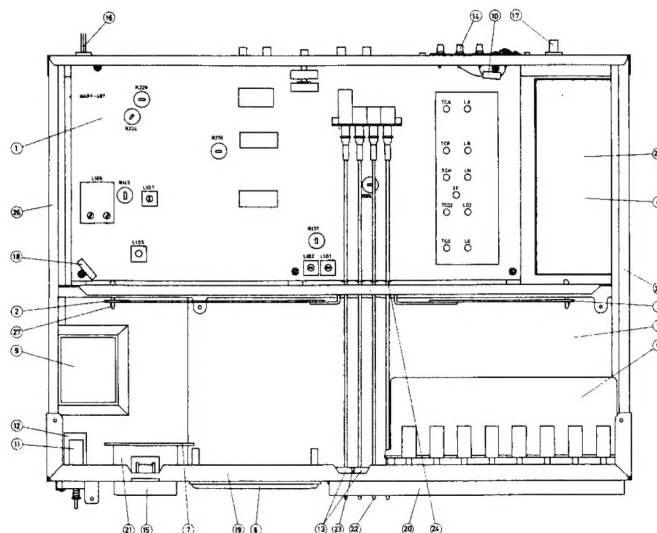
FRONT PANEL-EXPLODED VIEW



FRONT PANEL EXPLODED VIEW-PARTS LIST

Ref. No.	Parts No.	Description	Ref. No.	Parts No.	Description
51	28320240	Push switch knob	62	27300105	Support (R)
52	27267028	Push switch guide	63	27210096	Front panel
53	27267029	Push switch guide	64	28125038-1	End cap (R)
54	27180021	Spring	65	28125037-1	End cap (L)
55	87644010	W4+10F (BC)	66	8233006	3S+6FN (CR)
56	893030	E-3, Circlip	67	27267018	Power switch guide
57	27140201	Bracket	68	28191025	Dial glass
58	834130062	3STS+6BQ	69	82113006	3P+6FN
59	28148050	Door	70	28140106	Cushion
60	27300110	Hinge (R)	71	29380041	Label (A)
61	27300106	Support (L)	72	27270017A	Spacer

COMPONENT LOCATION



COMPONENT LOCATION-PARTS LIST

Ref. No.	Circuit No.	Parts No.	Description
1		13752587	NARF-487, RF/IF and MPX. pc board
2		13752585	NAPS-485, Power supply pc board
3		13752586	NAPS-486, Power supply pc board
4		13752522	NASYN-522, Synthesis pc board
5		13752589	NADIS-489, Display pc board
6		13752590	NACON-490, Converter pc board
7		13752592	NAPL-492, Meter illumination pc board
8	Q747	212001	5-LT-06, Fluorescent indicator tube
9	T001	230244	NPT-646G, Power transformer
10	T002	233026	NBLN-1, Balun transformer
11	C1	3500052	PME271Y510CEE, IS capacitor
12	S001	25035054	NPS-111-L19P, Power switch
13	S811, S812	25065051	NMS-1202, Microswitch
14		25060021B	NTM-3PUM1, Antenna terminal
15		243088	NIND-0500S88, Signal strength meter
16		253072	Power supply cord
17		25045012	FR3, Coaxial connector
18		25108002	MD2R, Terminal
19	A001	27110057	Front bracket
20	A005	27110058	Front bracket (R)
21	A002	27250015	Lamp case
22	A032	27260014	Shaft
23	A014	27140200	Bracket
24	A033	893020	E-2, Shaft
25	A021	27115032	Side bracket (R)
26	A022	27115033	Side bracket (L)
27	A029	27190009	Holder
28	A036	27150081	Shielded cover

ALIGNMENT PROCEDURES

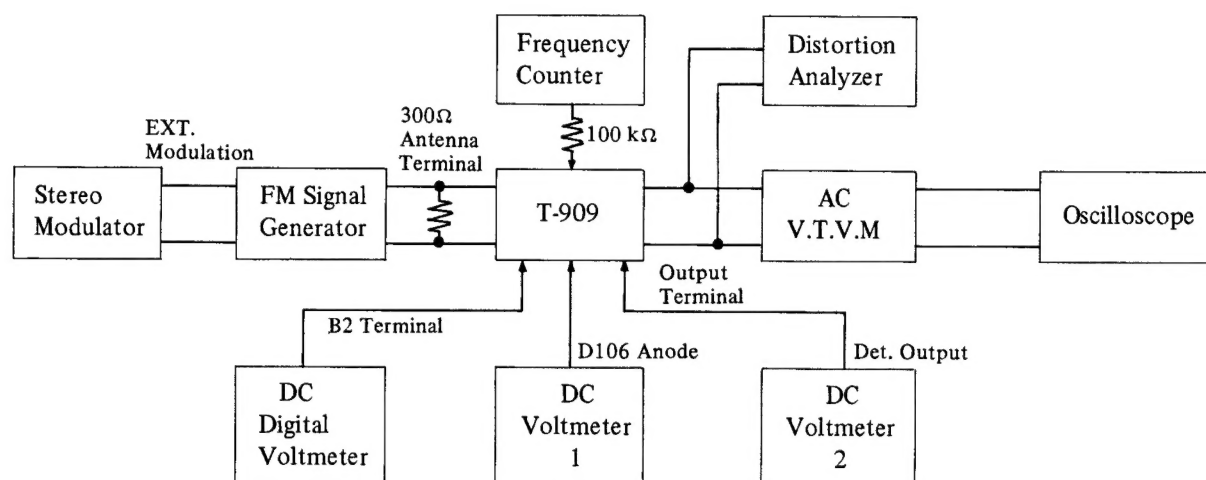
INSTRUMENTS REQUIRED

1. Stereo Modulator
2. FM Signal Generator with Frequency Counter
3. Frequency Counter
4. Digital DC Voltmeter
5. DC Voltmeter
6. Distortion Analyzer
7. AC V.T.V.M.
8. Oscilloscope

GENERAL ALIGNMENT CONDITION

1. Standard modulation is 1 kHz 100% (FM MONO), pilot 9% sub and main 91% (FM STEREO).
2. Standard knob position
 S1 (DOLBY NR ADAPT) OFF
 S2 (NOISE FILTER) OFF
 S3 (MODE) STEREO
 S4 (MUTING) OFF

CONNECTION DIAGRAM



(1) FM ALIGNMENT

Step	FM Signal Generator	Stereo Modulator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
1	88.1MHz, 65dBf 1kHz 75kHz devi.	_____	88.1MHz	LO	DC Digital Voltmeter	3.6V	Usually not necessary to adjust
2	103.9MHz, 65dBf 1kHz, 75kHz devi.	_____	103.9MHz	TCO		15.4V	
3	88.1MHz, 25dBf 1kHz, 75kHz devi.	_____	88.1MHz	L001 } L004	DC Voltmeter 1	Minimum	Repeat steps 3 and 4 as necessary
4	103.9MHz, 25dBf 1kHz, 75kHz devi.	_____	103.9MHz	TC001 } TC004			
5	98.1MHz, 25dBf 1kHz, 75kHz devi.	_____	98.1MHz	L106			
6	98.1MHz, 25dBf 1kHz, 75kHz devi.	_____	98.1MHz	L107 Bottom	DC Voltmeter 2	OV	
				L107 Upper	Distortion Analyzer	Minimum	
7	98.1MHz, 25dBf 1kHz, 75kHz devi	_____	98.1MHz	L105	AC V.T.V.M	Maximum	
8	98.1MHz, 65dBf EXT. Modulation	L+R 68.25kHz devi. Pilot sig. 6.75kHz devi.	98.1MHz	L101 L102	Distortion Analyzer	Minimum	

(2) MULTIPLEX ALIGNMENT

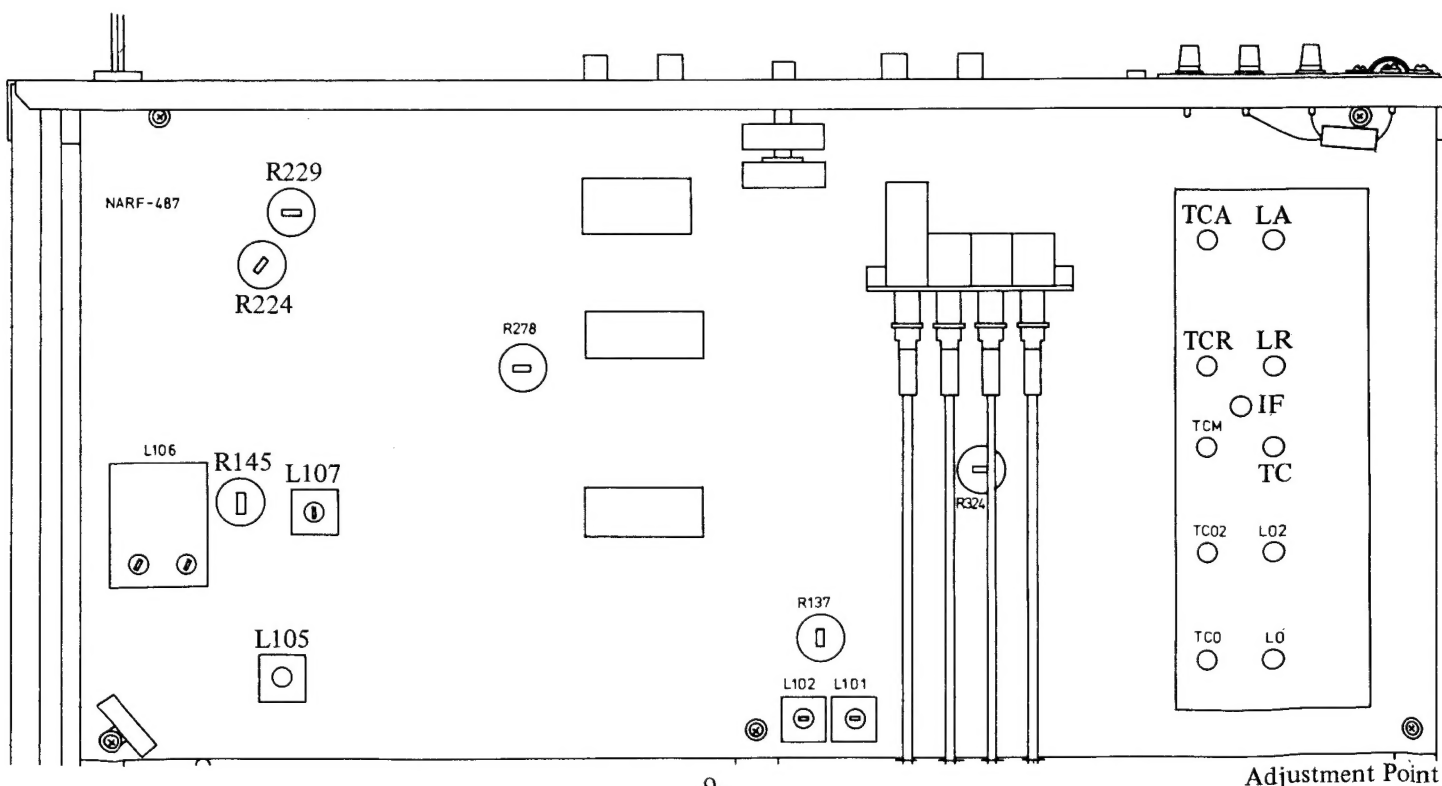
	FM Signal Generator	Stereo Modulator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
V.C.O	98.1MHz 65 dBf	—————	98.1MHz	R224	Frequency Counter	76kHz	Turn off the modulation
Pilot Cancel	98.1MHz 65dBf EXT. Modulation	Pilot Sig. 6.75kHz devi.	98.1MHz	R229	AC V.T.V.M	Minimum	
Separation	Same as above	Rch 68.25kHz devi. Pilot 6.75kHz 6.75kHz	98.1MHz	R278	AC V.T.V.M (Lch)	Minimum	Maximum and same Separation
		Lch 68.25kHz devi. Pilot 6.75kHz devi.			AC V.T.V.M (Rch)	Minimum	

(3) MUTING CIRCUIT

FM Signal Generator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
98.1MHz. 17dBf	98.1MHz	R145	Oscilloscope	Signal	Set the muting Switch to ON.
98.1MHz. 16dBf				No Signal	
98.1MHz, 65dBf 1kHz, 75kHz devi.	98.1MHz	R324	DC Voltmeter	Same Voltage	Connect the DC Voltmeter across the gates of Q ₃₂₁

(4) SIGNAL STRENGTH METER CALLIBRATION

FM Signal Generator	Dial to set	Adjust	Output Indicator	Adjust for
98.1MHz, 65dBf 1kHz, 75kHz devi.	98.1MHz	R139	Signal Strength Meter	60



DIGITAL SECTION P.C.B.-PARTS LIST**SYNTHESIS PC BOARD****(NASYN-522)-PARTS LIST**

Circuit No.	Parts No.	Description
ICs		
Q761	222495	HD74S112
Q762	222484	HD74S74
Q763	222493	SN74LS192
Q764, Q765	222494	SN74LS193
Q766	222479	HD7427
	222442 or	SN7427 or
Q767	222488	HD7420
	222428 or	SN7420 or
Q768, Q769	222491	HD74293
Q770	222501	HD7474
Q771	222477	TC5081
Transistors		
Q772	2211192	2SC380A(O)
Q773, Q774	2210675	2SC1681(GR)
Capacitor		
C761	3500056	1 μ F, 16V, CA
X'tal		
X801	3010029	XTL-6.4M
Shielded case		
	27225027	

DISPLAY PC BOARD**(NADIS-489)-PARTS LIST**

Circuit No.	Parts No.	Description
ICs		
Q701-Q704	222478	HD7400
Q706	222481	HD7410
Q707	222487	HD74192
Q708, Q709	222492	HD74193
	222504 or	SN74193 or
Q710, Q711	222489	HD7430
Q712	222490	HD7486
	222505 or	M53286 or
Q713	222481	HD7410
Q714	222478	HD7400
Q715	222480	HD7432
Q716, Q718	222481	HD7410
Q717, Q719	222478	HD7400
Q720, Q722	222481	HD7410
Q721, Q723	222481	HD7410
Q724, Q725	222503	SN74LS47
	222483 or	SN7447AN or
Q726-Q728	222475	TC4049
Q729, Q730	222484	HD7404
Transistors		
Q731-Q746	2211255	2SC1815(GR)
Fluorescent indicator tube		
Q747	212001	5-TL-06
Diodes		
D701, D702	223105	1S1555
Capacitors		
C701	352722211	220 μ F, 6.3V, Elect.

Circuit No.	Parts No.	Description
C703	374122235	0.022 μ F \pm 10%, 50V, DE
C704	352922206	22 μ F, 6.3V, NP
C708	352721011	100 μ F, 6.3V, Elect.
C713	352732202	22 μ F, 10V, Elect.
C714	352742201	22 μ F, 16V, Elect.

CONVERTER PC BOARD**(NACON-490)-PARTS LIST**

Circuit No.	Parts No.	Description
ICs		
Q751, Q754	222478	HD7400
Q755	222481	HD7410
Transistors		
Q756, Q757	2211255	2SC1815(GR)
Diodes		
D711-D714	2231031	1N60N(FM)
D718, D720		
Capacitor		
C731	352734701	47 μ F, 10V, Elect.
Switch		
	25035074	NPS-822-L39, Memory/Scan

MEMORY PC BOARD**(NAMEM-491)-PARTS LIST**

Circuit No.	Parts No.	Description
Diode arrays		
D731-D737	225016	DAN401
D741-D747	225017	DAN601
Switches		
S801-S807	25065043	NDS-10102, DIP

METER ILLUMINATION PC BOARD**(NAPL-492)-PARTS LIST**

Circuit No.	Parts No.	Description
	210032	0.25A, 6.3V, Pilot lamp
	451731504	15 Ω , 2W, MOF resistor

L.E.D. PC BOARD**(NALE-493)-PARTS LIST**

Circuit No.	Parts No.	Description
D801-D810	225020	TLR122, L.E.D.

NOTES: Capacitor

CA: Aluminum solid electrolytic capacitor

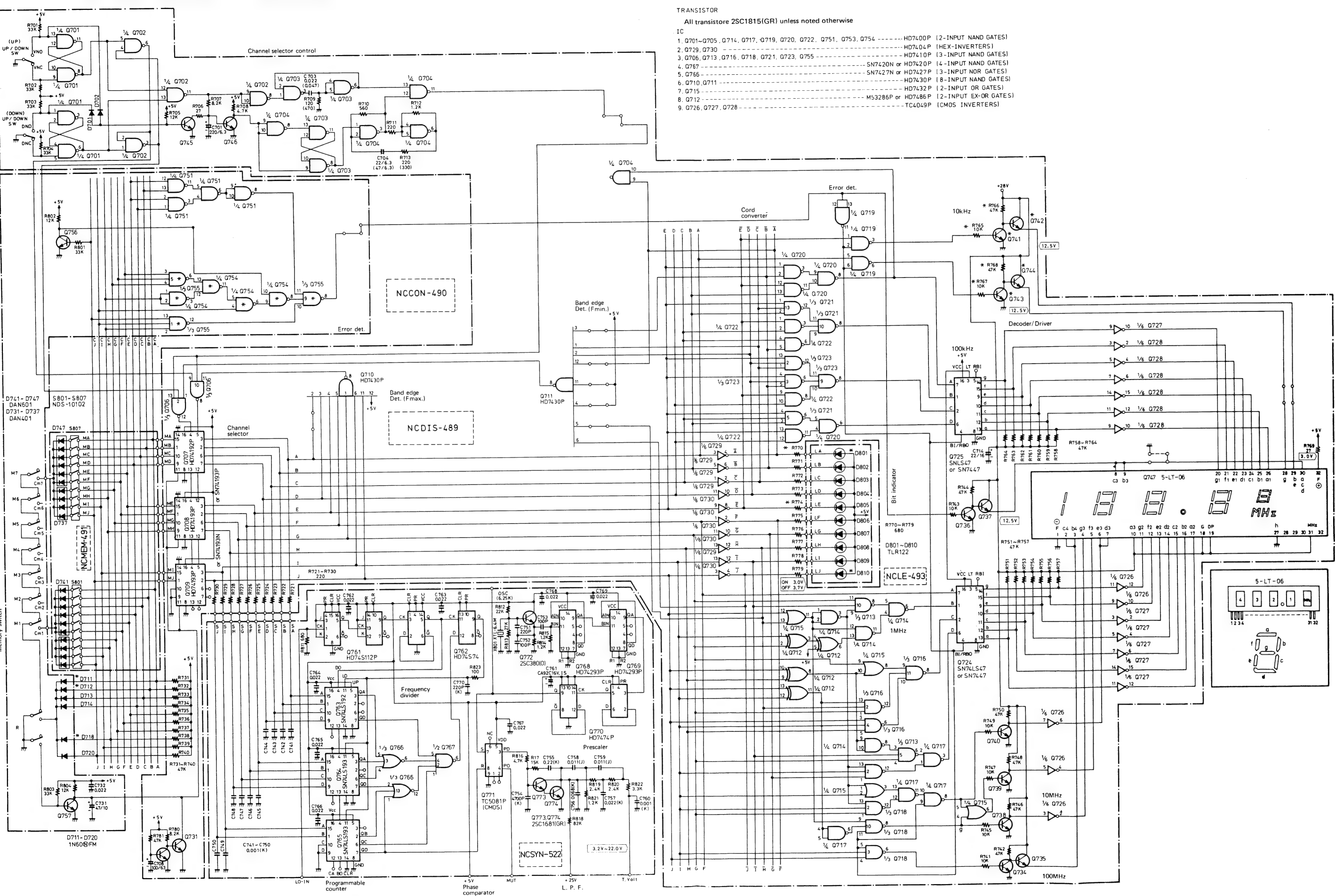
DE: Non-inductive polyester film capacitor

NP: Non-polar electrolytic capacitor

Resistor

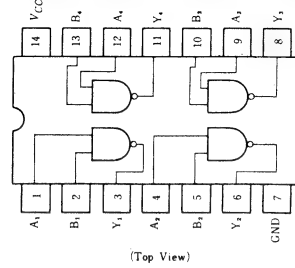
MOF: Metal oxide film resistor

DIGITAL SECTION-SCHEMATIC DIAGRAM

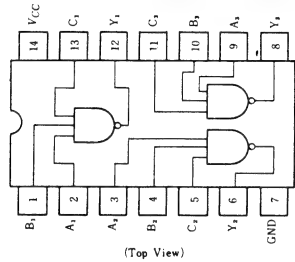


PIN ARRANGEMENT FOR DIGITAL IC**HD7400**

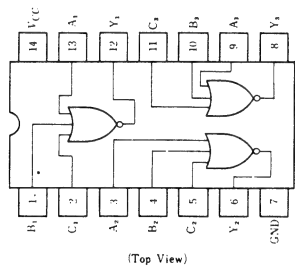
(Quadruple 2-input Positive NAND Gates)

**HD7410**

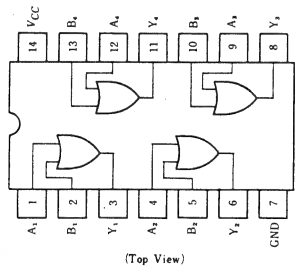
(Triple 3-input Positive NAND Gates)

**SN7427, HD7427**

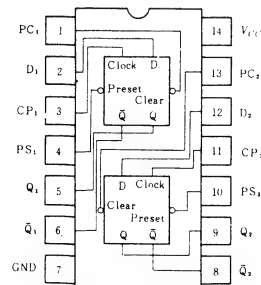
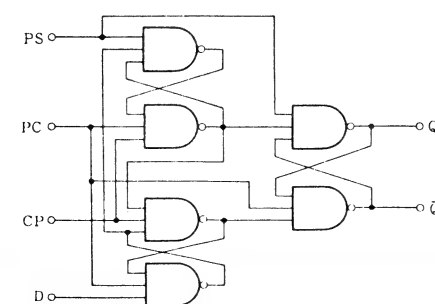
(Triple 3-input Positive NOR Gates)

**HD7432**

(Quadruple 2-input Positive OR Gates)

**HD7474
HD74S74**

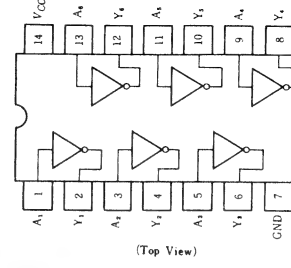
(Dual D-Type Edge-Triggered Flip-Flops)

**BLOCK DIAGRAM**

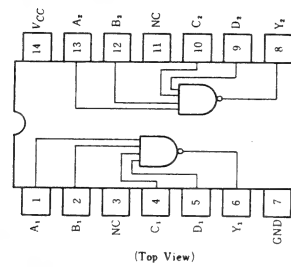
- NOTES) 1. ↑: Transition from low to high level
2. The level of Q₀ before the indicated input conditions were established.
3. X: irrelevant

HD7404

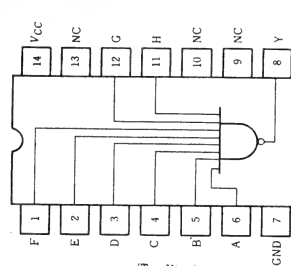
(Hex Inverters)

**HD7420, SN7420**

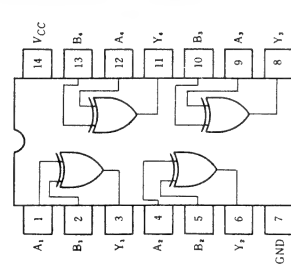
(Dual 4-input Positive NAND Gates)

**HD7430**

(8-input Positive NAND Gates)

**HD7486**

(Quadruple 2-input Exclusive-OR Gates)

**TRUTH TABLE**

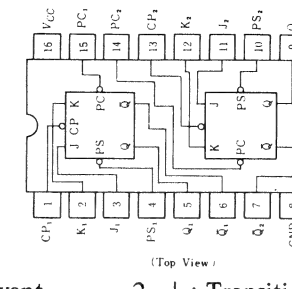
Input		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

TRUTH TABLE

Inputs				Outputs	
PS	PC	CP	D	Q	Q̄
0	1	X	X	1	0
1	0	X	X	0	1
0	0	X	X	1	1
1	1	↑	1	1	0
1	1	↑	0	0	1
1	1	0	X	Q ₀	Q̄ ₀

HD74S112

Dual J-K Negative Edge-Triggered Flip-Flops with Preset and Clear

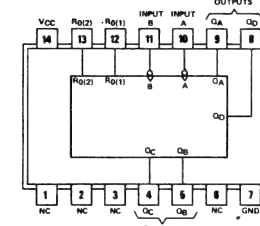


Input					Output	
PS	PC	CP	J	K	Q	Q̄
0	1	X	X	X	1	0
1	0	X	X	X	0	1
0	0	X	X	X	1*	1*
1	1	↓	0	0	Q ₀	Q̄ ₀
1	1	↓	1	0	1	0
1	1	↓	0	1	0	1
1	1	↓	1	1	Toggle	Toggle
1	1	1	X	X	Q ₀	Q̄ ₀

- NOTES: 1. X : irrelevant 2. ↓ : Transition from high to low level
3. The level of Q₀ before the indicated input conditions were established.
4. Toggle : Each output changes to the complement of its previous level on each active transition (pulse) of the clock.
5. * : This configuration is nonstable; that is, it will not persist when present and clear inputs return to their inactive (high) level.

HD74LS293

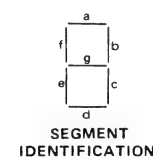
Decade and 4-bit Binary Counter

**COUNT SEQUENCE**

COUNT	Q ₀	Q ₁	Q ₂	Q ₃	Q ₄
0	L	L	L	L	L
1	L	L	L	H	L
2	L	L	H	L	L
3	L	L	H	H	L
4	L	H	L	L	L
5	L	H	L	H	L
6	L	H	H	L	L
7	L	H	H	H	L
8	H	L	L	L	L
9	H	L	L	H	L
10	H	L	H	L	L
11	H	L	H	H	L
12	H	H	L	L	L
13	H	H	L	H	L
14	H	H	H	L	L
15	H	H	H	H	L

NOTE: Output Q_A is connected to input B**SN74LS47, SN7447**

BCD-to-Seven-Segment Decoders/Drivers



NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

FUNCTION TABLE

DECIMAL OR FUNCTION	INPUTS						BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	1
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	
6	H	X	L	H	H	L	H	OFF	OFF	ON	ON	ON	ON	ON	
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	2
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	
9	H	X	H	L	L	H	H	ON	ON	ON	ON	OFF	ON	ON	
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
RBI	L	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	4

H = high level, L = low level, X = irrelevant

- NOTES: 1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.
2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.
3. When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).
4. When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

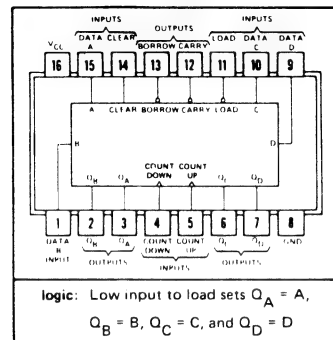
†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

HD74192, SN74LS192, HD74193, SN74193, SN74LS193

Synchronous 4-bit Up/Down counters (Dual Clock with clear)

PIN ARRANGEMENT

(TOP VIEW)



DESCRIPTION

The 192 and LS192 circuits are BCD counters and the 193 and LS193 circuits are 4-bits binary counters.

The outputs of the four master-slave flip-flops are triggered by a low-to-high-level transition of either count (clock) input. The direction of counting is determined by which count input is pulsed while the other count input is high.

All four counters are fully programmable; that is, each output may be preset to either level by entering the desired data at the data inputs while the load input is low. The output will change to agree with the data inputs independently of the count pulses. This feature allows the counters to be used as modulo-N dividers by simply modifying the count length with the preset inputs.

A clear input has been provided which forces all outputs to the low level when a high level is applied. The clear function is independent of the count and load inputs. The clear, count, and load inputs are buffered to lower the drive requirements. This reduces the number of clock drivers, etc., required for long words.

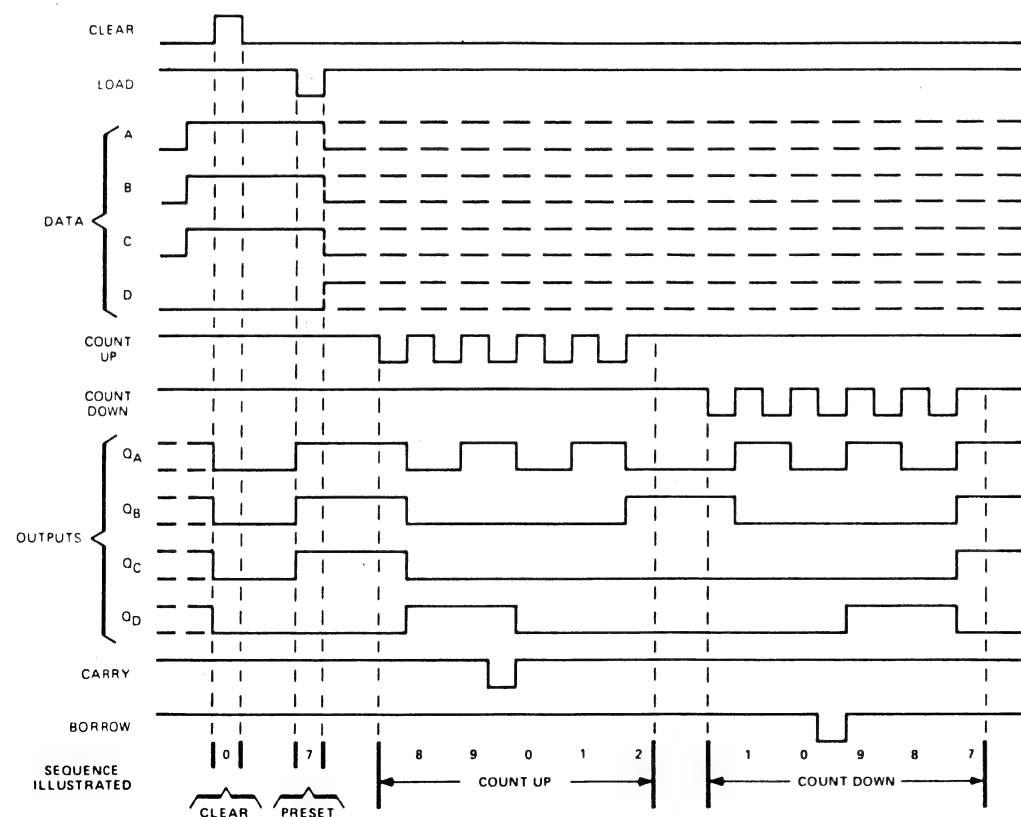
These counters were designed to be cascaded without the need for external circuitry. Both borrow and carry outputs are available to cascade both the up- and down-counting functions. The borrow output produces a pulse equal in width to the count-down input when the counter underflows. Similarly, the carry output produces a pulse equal in width to the count-up input when an overflow condition exists. The counters can then be easily cascaded by feeding the borrow and carry outputs to the count-down and count-up inputs respectively of the succeeding counter.

HD74192, SN74LS192

typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to BCD seven.
3. Count up to eight, nine, carry, zero, one, and two.
4. Count down to one, zero, borrow, nine, eight, and seven.



NOTES: A. Clear overrides load, data, and count inputs.

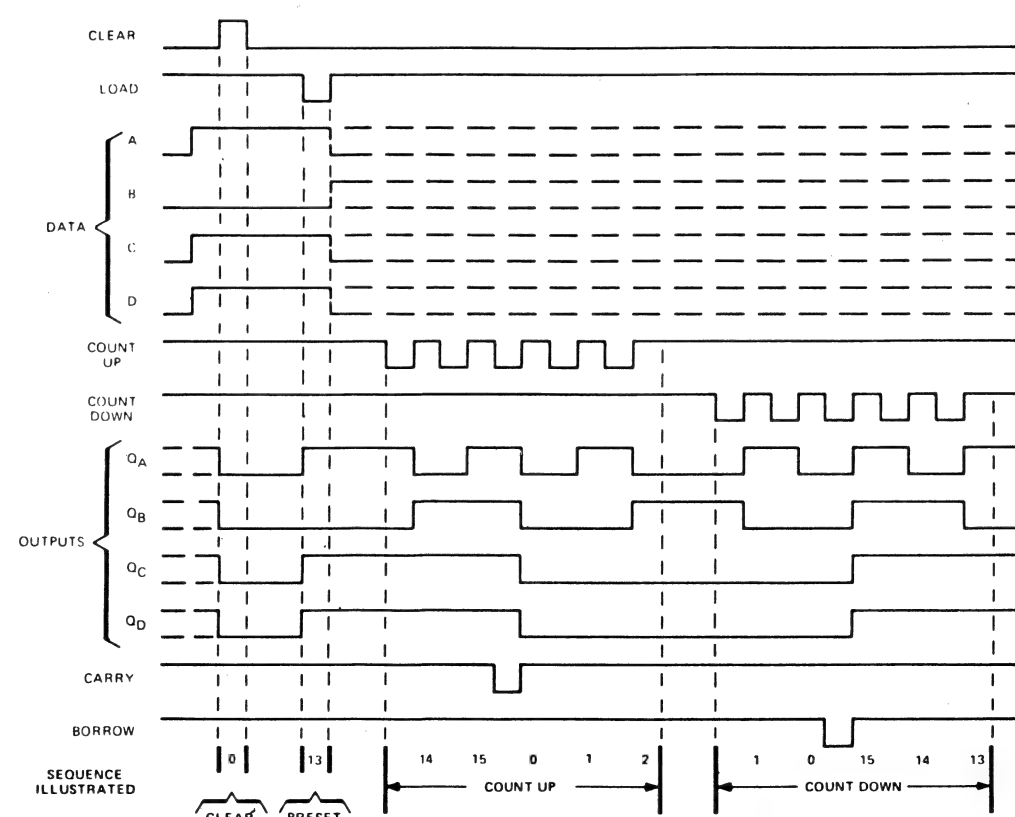
B. When counting up, count-down input must be high; when counting down, count-up input must be high.

HD74193, SN74LS193, SN74193

typical clear, load, and count sequences

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to binary thirteen.
3. Count up to fourteen, fifteen, carry, zero, one, and two.
4. Count down to one, zero, borrow, fifteen, fourteen, and thirteen.



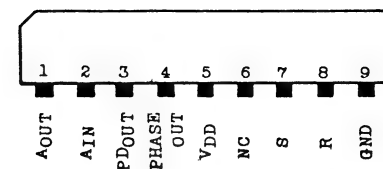
NOTES: A. Clear overrides load, data, and count inputs.

B. When counting up, count-down input must be high; when counting down, count-up input must be high.

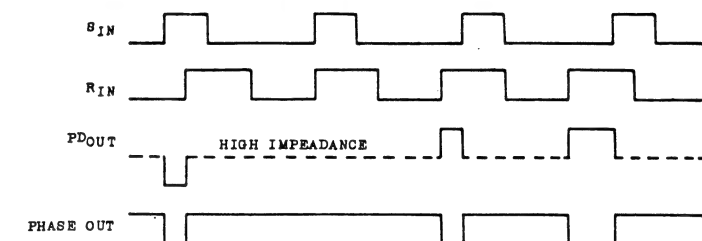
TC5081P

Phase Comparator and Amplifier

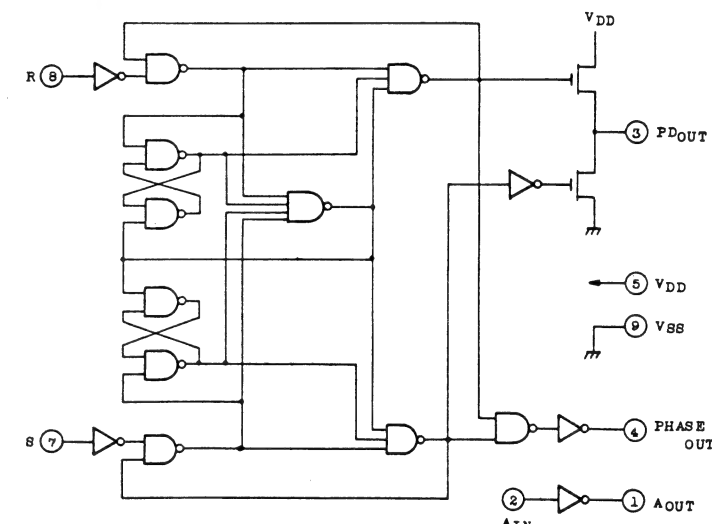
PIN CONNECTION



PHASE COMPARATOR TIMMING CHART



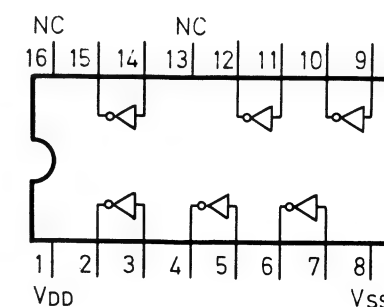
LOGIC DIAGRAM



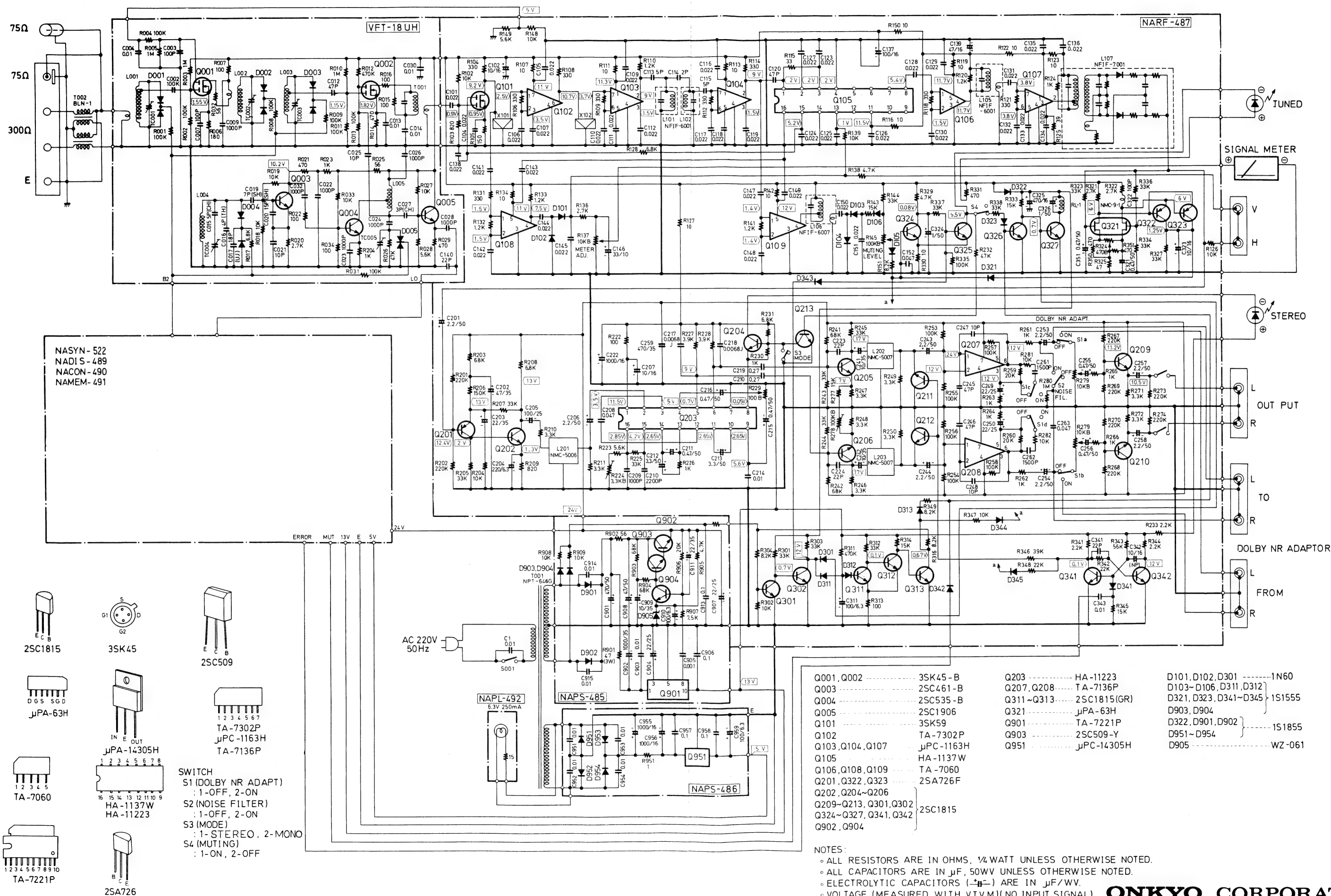
TC4049B

Hex Buffer Converter Inverting Type

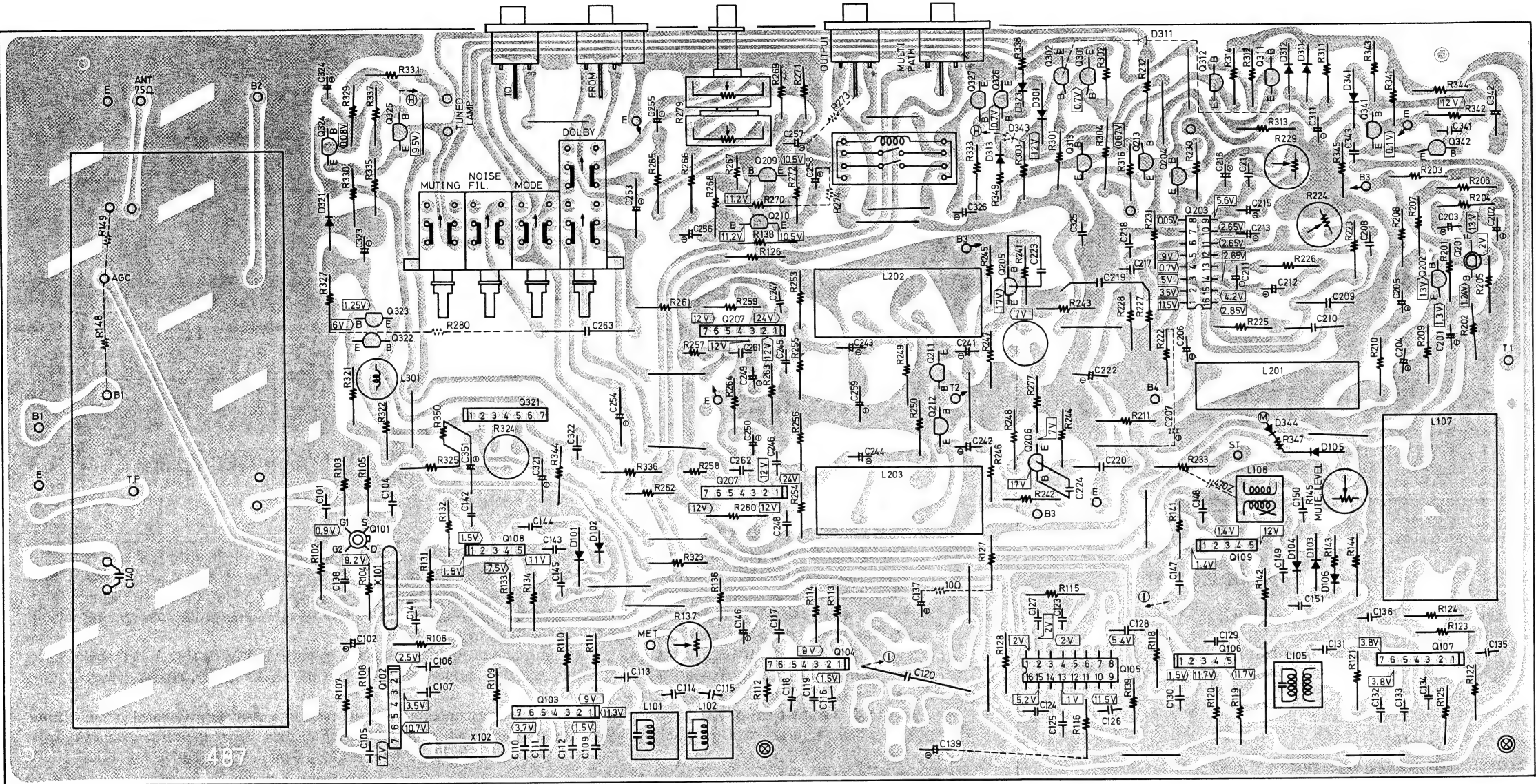
PIN ARRANGEMENT



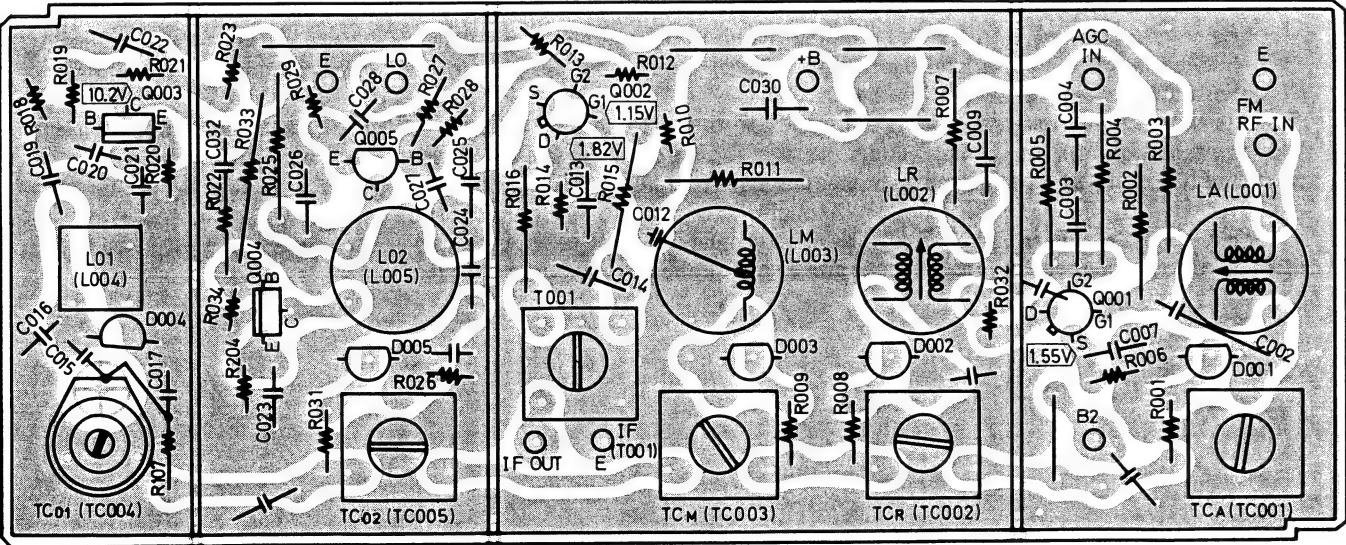
TUNER-SCHEMATIC DIAGRAM



TUNER PC BOARD VIEW FROM BOTTOM SIDE

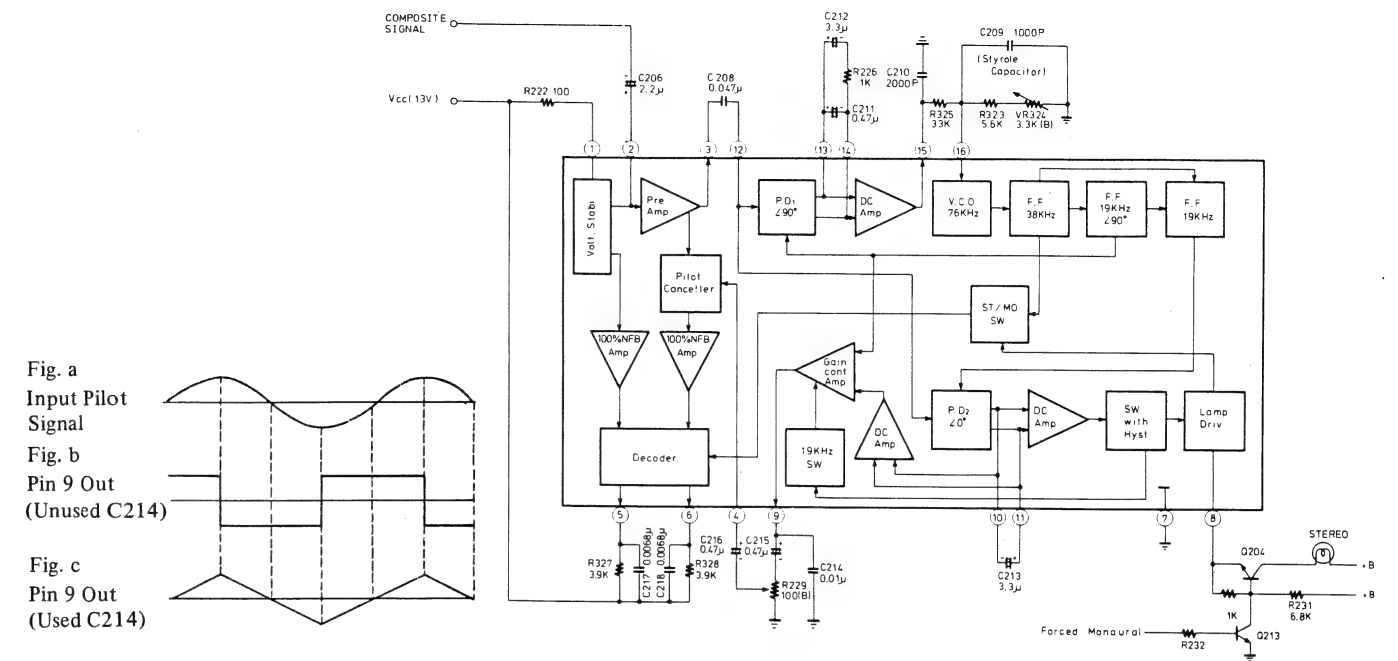


FRONT END PC BOARD VIEW FROM BOTTOM SIDE



**RF/IF AND MPX. PC BOARD
(NARF-487) -PARTS LIST**

Circuit No.	Parts No.	Description	Circuit No.	Parts No.	Description
Front end			C212, C213	352780331	3.3μF, 50V, Elect
	240039	VFT-18UH	C215, C216	352784791	0.47μF, 50V, Elect.
ICs			C219, C220	374122747	0.27μF±20%, 50V, DE
Q102	222452	TA-7302P	C222	352741021	1,000μF, 16V, Elect.
Q103, Q104	222474	μPC-1163H	C241, C242	352761001	10μF, 35V, Elect.
Q107			C243, C244	352780221	2.2μF, 50V, Elect.
Q105	222421	HA-1137W	C249, C250	352752201	22μF, 25V, Elect.
Q106, Q108			C253, C254		
Q109	222407	TA-7060P	C257, C258	352780221	2.2μF, 50V, Elect.
Q203	222458	HA-11223	C255, C256	352784791	0.47μF, 50V, Elect.
Q207, Q208	222423	TA-7136P	C259	352764711	470μF, 35V, Elect
Transistors			C311	352721011	100μF, 6.3V, Elect.
Q101	2211235	3SK59(GR), F.E.T	C321	352784791	0.47μF, 50V, Elect.
Q201, Q322	2210416	2SA726(F)	C323	352741001	10μF, 16V, Elect.
Q323			C324	352780101	1μF, 50V, Elect.
Q202, Q204			C325	352744711	470μF, 16V, Elect.
Q205, Q206			C326	352780221	2.2μF, 50V, Elect.
Q209-Q213			C342	352941006	10μF, 16V, NP
Q301, Q302	2211255	2SC1815(GR)	C146	352733301	33μF, 10V, Elect.
Q311-Q313			C351	352784791	0.47μF, 50V, Elect.
Q324-Q327			Resistors		
Q341, Q342			R137	5225015	N10HR10KBD,SF
Q321	2211282	μPA63(H)L, F.E.T.	R145	5225016	N10HR100KBD,SF
Diodes			R224	5225071	N10HR3.3KBIM,SF
D101, D102	223103	1N60	R229	5225016	N10HR100KBD,SF
D301			R278	5225016	N10HR100KBD,SF
D103-D106 ,			R279	5172051	N24RGL10KB15H,
D311-D313	223105	1S1555			Output level control
D321, D323			R324	5225026	N10HR470BD,SF
D341, D345			Switches		
D322	223802	1S1885	S1-S4	25035073	NPS-422-L38
Transformers			Terminals		
L101, L102	233096	NFIF-6001	P1,P2	25045043	NPJ-4PDBL20
L105			Relay		
L106	233125	NFIF-6007	RL1	25065048	FRL-644D12/2AS
L107	233127	NFIF-7001			
Coils			NOTES: Capacitor		
L201	233123	NMC-5006	ST: Polystyren film capacitor		
L202, L203	233124	NMC-5007	DE: Non-inductive polyester film capacitor		
L301	233031	NMC-9-1	NP: Non-polar electrolytic capacitor		
Ceramic filters			Resistor		
X101, X102	3010028	CFM107K14	SF: Semi-fixed variable resistor		
Capacitor					
C102	352741001	10μF, 16V, Elect.			
C139	352744701	47μF, 16V, Elect.			
C201	352780221	2.2μF, 50V, Elect.			
C202	352764701	47μF, 35V, Elect.			
C203	352762201	22μF, 35V, Elect.			
C204	352722211	220μF, 6.3V, Elect.			
C205	352751011	100μF, 25V, Elect.			
C206	352780221	2.2μF, 50V, Elect.			
C207	352741001	10μF, 16V, Elect.			
C209	372321025	1,000pF±10%, 50V, ST			
C211	352784791	0.47μF, 50V, Elect.			

BLOCK DIAGRAM
HA11223 (PLL FM Stereo Demodulator with Pilot Cancel)

1. Pilot Cancel Circuit Operations

The composite signal input from pin 2 is amplified by the Pre-Amp circuit, and then it is output to pin 3. This signal is input to pin 12 and, one part is input to the PLL circuit and the other to the lamp driver circuit. The PLL circuit locks out the pilot signal by the signal which has been input to the PLL circuit, and the signal in the PLL circuit generates three kinds of signals, 76 kHz, 38 kHz, and 19 kHz. The 19 kHz signal whose phase is advancing 90° more than the pilot signal is input to the Gain Control Amp.

On the other hand, the signal input to the lamp driver circuit is detected synchronously by the 19 kHz signal with the same phase as the pilot signal generated by the PLL circuit, and sent to pin 10 and pin 11 as a DC signal in proportion to the level of the pilot signal.

The DC signal is amplified by DC-Amp, and used as the control signal of the above mentioned Gain Control Amp. Therefore, when there is no load capacity C214 in the output of pin 9 that has been output from the Gain Control Amp., a rectangle wave with a phase of 90° advanced as compared with the input pilot signal will appear as indicated in the right figure b.

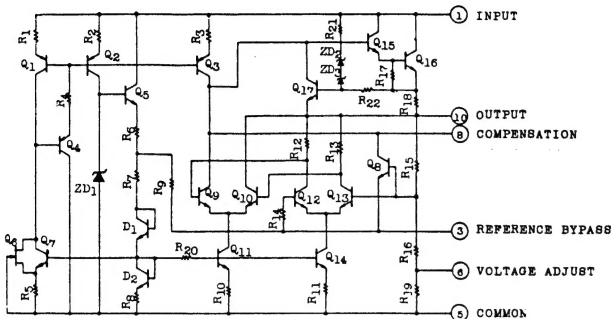
As a matter of fact, however, since there is C214, a triangular wave that is in the same phase as the input pilot signal will appear as shown in Fig. C. The level of the triangular wave correlates with the input pilot signal level and it disperses due to dispersion of IC within the circuit. Therefore, it is necessary to adjust properly the level by R229 (100 Ω B). This level adjusted triangular wave is input to pin 4 and is phase inverted by the transistor into IC, then added to the input pilot signal.

Since the pilot cancel of HA11223 is utilizing the above mentioned triangular wave injection, when the difference between the pilot signal and the fundamental frequency component of the triangular wave is eliminated, the odd high harmonics of the triangular wave will remain.

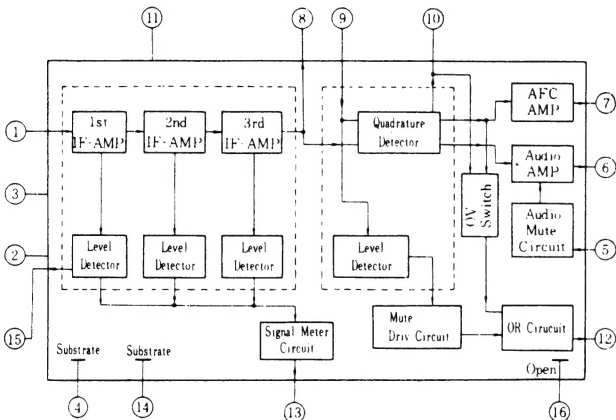
This high harmonic components are, needless to say, the odd times of 19 kHz, but when this signal is turned on by switching transistors of the decoder, as the 38 kHz rectangular wave, it causes beat with the high harmonics that are the odd times of 38 kHz, and generates a signal of 19 kHz component again.

As a result of this, the signal of 19 kHz component that appears at the output pin becomes easier to be unbalanced at pin 5 and at pin 6. Therefore, for the above mentioned adjustments of R229, it becomes necessary to make each 19 kHz component appearing at pin 5 and at pin 6 the same and to maximize them.

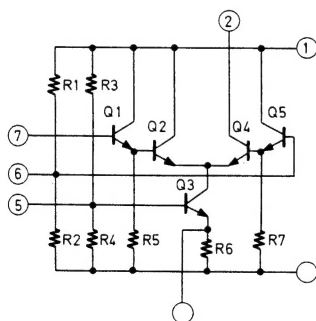
TA7221P (Voltage regulator) EQUIVALENT CIRCUIT



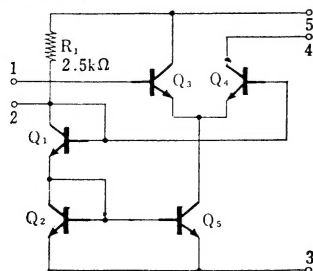
HA1137W (FM IF ampli. and Det.) BLOCK DIAGRAM



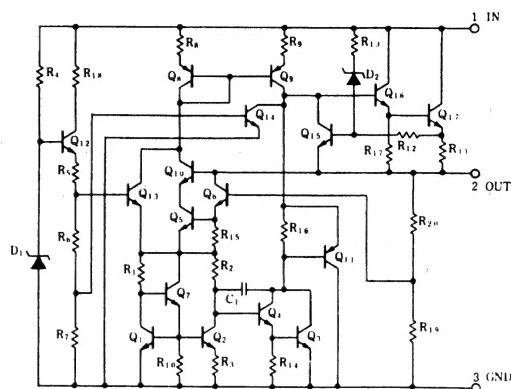
μ PC1163H (FM IF ampli.)
EQUIVALENT CIRCUIT



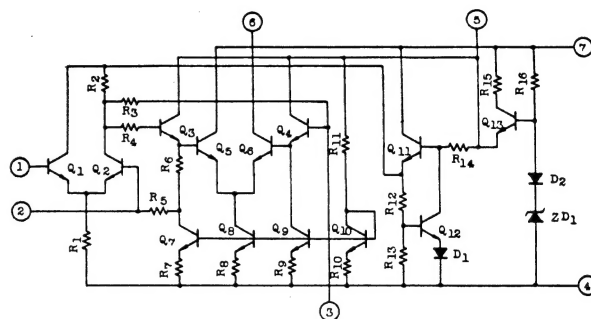
TA7060P (FM IF ampli.) EQUIVALENT CIRCUIT



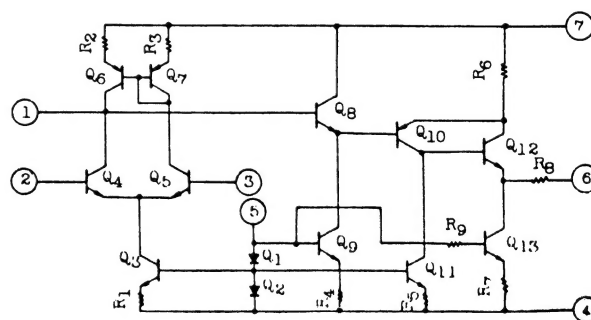
μ PC14305H (Voltage regulator) EQUIVALENT CIRCUIT



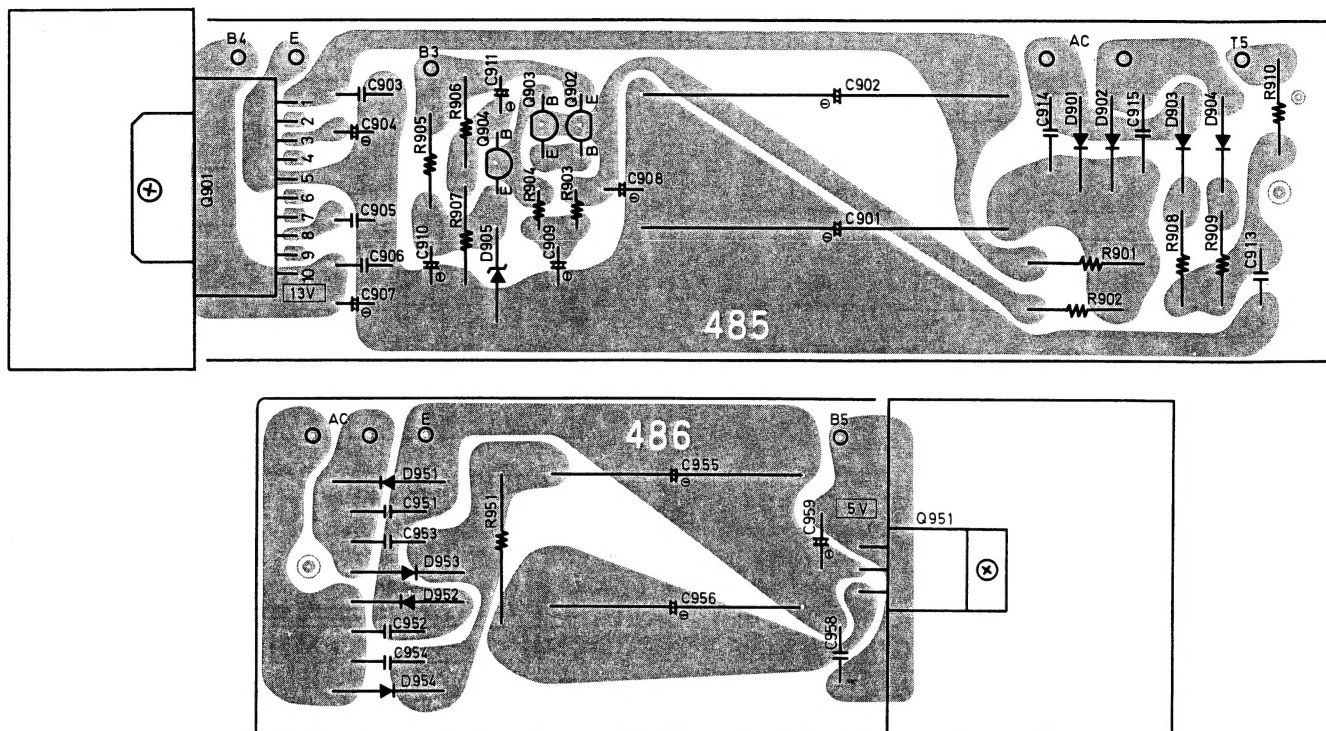
TA7302P (FM IF ampli.) EQUIVALENT CIRCUIT



TA7136P (Preampli) EQUIVALENT CIRCUIT



POWER SUPPLY PC BOARD VIEW FROM BOTTOM SIDE



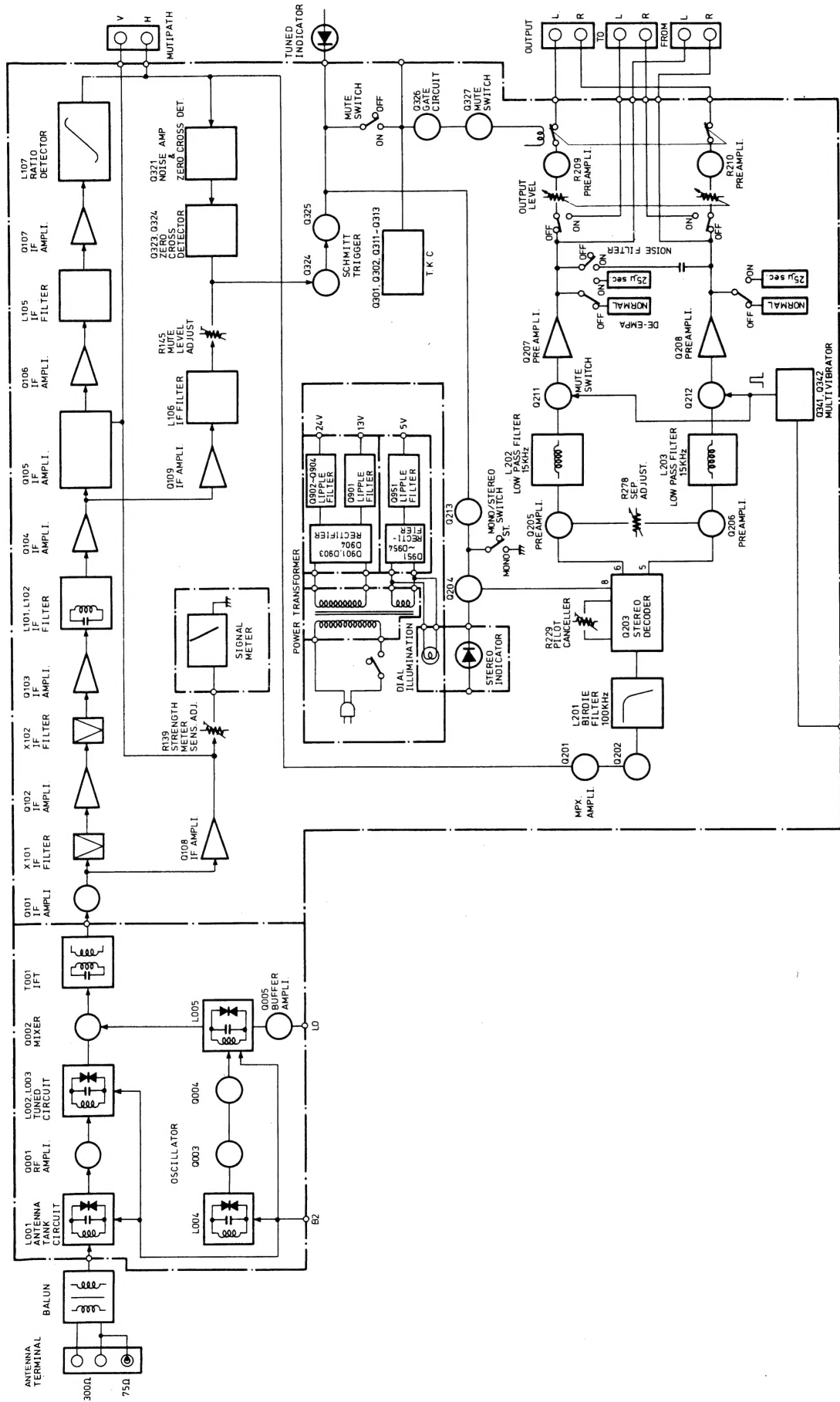
POWER SUPPLY PC BOARD (NAPS-485)-PARTS LIST

Circuit No.	Parts No.	Description
IC		
Q901	222472	TA-7221P
Transistors		
Q902	2210901	2SC509(Y)
Q903, Q904	2211255	2SC1815(GR)
Diodes		
D901-D904	223802	1S1885
D905	223928	WZ-061
Capacitors		
C901	351784711	470 μ F, 50V, Elect.
C902	351761021	1,000 μ F, 35V, Elect.
C904	352752201	22 μ F, 25V, Elect.
C907	352752201	22 μ F, 25V, Elect.
C908	352784701	47 μ F, 50V, Elect.
C909	352761001	10 μ F, 35V, Elect.
C910	352721011	100 μ F, 6.3V, Elect.
C911	352762201	22 μ F, 35V, Elect.
Resistor		
R901	441824704	47 Ω , 3W, MOF
Radiator		
	27160039	RAD-09

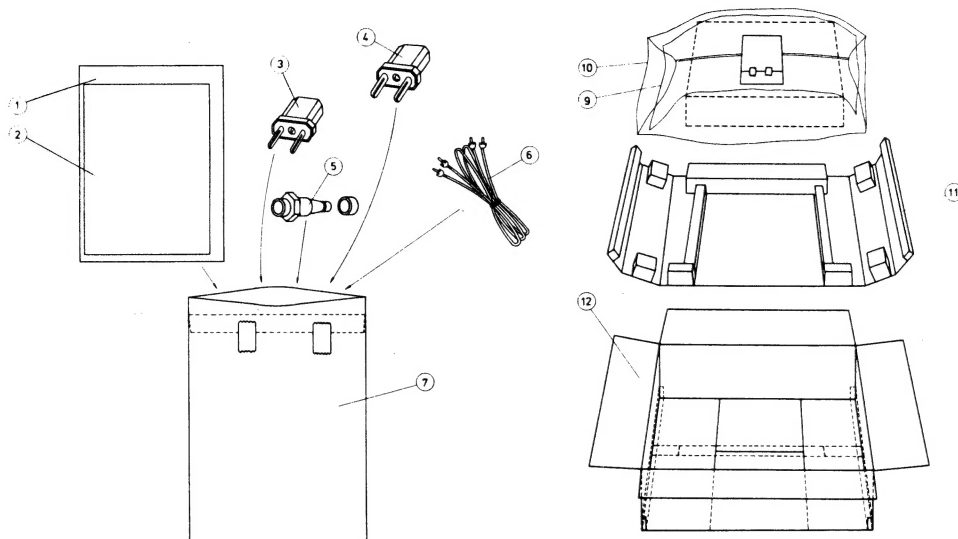
POWER SUPPLY PC BOARD (NAPS-486)-PARTS LIST

Circuit No.	Parts No.	Description
IC		
Q951	222496	μ PC14305H
Diodes		
D951-D954	223802	1S1885
Capacitors		
C955, C956	351741021	1,000 μ F, 16V, Elect.
C959	325721011	100 μ F, 6.3V, Elect.
Resistor		
R951	451730104	1 Ω , 2W, Metal
Radiator		
	27160038	RAD-08

BLOCK DIAGRAM



PACKING PROCEDURES



PACKING PROCEDURES-PARTS LIST

Ref. No.	Parts No.	Description
1	29340262	Instruction manual
2	29365005	Warranty card (V)
	29380034	Sticker (G)
3	292005	CV-C, Conversion plug
4	292006	CV-BS, Conversion plug (G)
5	25055004	FP-3, Coaxial connector
6	2010034	Pin plug cord
7	29100006	250 x 350mm, Poly bag
8	13752119	Accessory bag complete (V)
	13745119	Accessory bag complete (G)
9	29095012	500 x 800mm, Protection sheet
10	29100019A	550 x 850mm, Poly bag
11	29090229	Pad
12	29050187	Carton box
	29380042	Label (B) (Back panel)
	27300107	Programming stylus

(V) : German Model

(G) : Europe Model

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